REMARKS

Claims 23-45 are pending and were rejected. Claims 23 and 40 are being amended. Claims 23, 31, 39, and 40 are independent. The applicant respectfully requests reconsideration of the rejections in view of the following remarks.

Section 103 Rejections

Claims 23-26, 28, 29, 31-34, 36, 37, 39-41 and 45 stand rejected under 35 U.S.C. Section 103(a) as being unpatentable over U.S. Patent No. 5,649,152 to Ohran et al. ("Ohran"), in view of "File System Design for an NFS File Server Appliance" by Hitz et al. ("Hitz"), further in view of U.S. Patent No. 5,867,733 to Meyer ("Meyer").

Claim 23 recites a controller that includes snapshot logic, copy logic, and an internal cache. The controller receives a snapshot command issued by a replication manager. The snapshot logic makes a snapshot map and snapshot data in response to the snapshot command. The copy logic copies data from the source volume directly to the target volume without having a file server in the data path. The copy logic uses the snapshot map and the snapshot data to maintain coherency of the copied data.

Ohran discloses a system for making computer mass storage snapshots. It includes a digital computer 102 and a mass storage device 104, see figure 1. The mass storage device is a SCSI or IDE hard drive connected "through an appropriate controller," see column 3, lines 63-65. Nowhere else in Ohran is the function of the controller discussed.

The examiner asserts that Ohran teaches a controller with snapshot logic and copy logic, pointing to column 4, lines 20-35. The text of Ohran is as follows:

> In step 202, preservation memory 106 is cleared. In general, this will consist of setting the control information describing the contents of preservation memory 106 to indicate that there are no valid entries in preservation memory 106.
>
> In step 204, a virtual device appearing as a mass storage device is created. The method for creating a virtual device will depend on the particular operating system running on digital computer 102, but will be known by one skilled in the art of that particular operating system. In addition, it may be

> necessary in step 204 to configure the operating system so that the method of this invention intercepts any read or write operation directed to mass storage system 104. Again, how this is done will be dependent on the particular operating system running on digital computer 102.

This section from Ohran discloses a method of configuring a computer. Ohran does not disclose snapshot logic or copy logic having the functionality recited in claim 23.

Moreover claim 23 recites a <u>controller</u> which includes the snapshot logic and copy logic. Ohran implements his method in a file server, by which he means a general purpose computer, see column 6, lines 56-57, and figure 3. Ohran says almost nothing about his controller. Therefore, Ohran does not teach a controller with snapshot logic and copy logic. Ohran also fails to teach that a controller's snapshot logic uses a snapshot map and a snapshot data to maintain coherency of copied data.

The examiner admits that "Ohran does not explicitly teach a system wherein the snapshot operations are carried out and managed by a storage device controller," and looks instead to Hitz for this limitation. Even if Ohran taught snapshot logic or copy logic, Hitz would not overcome this deficiency.

Hitz discloses a network appliance called FAServer NFS Appliance, see second paragraph of page 5. The appliance is a special-purpose computer that functions as a network file server. The appliance stores files, which can be read and written by networked client computers, see page 19.

Claim 23 recites a controller with snapshot logic and copy logic. The examiner asserts that Hitz "teaches a system wherein the snapshot operations are carried out in and managed by a storage device controller." The examiner cites to the abstract and the introduction to support the proposition that the system is a storage device "controller" managing snapshots. The abstract and the first few paragraphs of the introduction are as follows:

> Abstract
>
> Network Appliance recently began shipping a new kind of network server called an NFS file server appliance, which is a dedicated server whose sole function is to provide NFS file service. The file system requirements for an NFS appliance are different from those for a general-purpose UNIX system,

> both because an NFS appliance must be optimized for network file access and because an appliance must be easy to use.
>
> This paper describes WAFL (Write Anywhere File Layout), which is a file system designed specifically to work in an NFS appliance. The primary focus is on the algorithms and data structures that WAFL uses to implement Snapshots, which are read-only clones of the active file system. WAFL uses a copy-on-write technique to minimize the disk space that the Snapshots consume. This paper also describes how WAFL uses Snapshots to eliminate the need for file system consistency checking after an unclean shutdown.
>
> 1. Introduction
>
> An appliance is a device designed to perform a particular function. A recent trend in networking has been to provide common services uses appliance instead of general-purpose computers. For instance, special-purpose routers from companies like Cisco and Bay Networks have almost entirely replaced general-purpose computers for packet routing, even though general purpose computers originally handled all routing. Other examples of network appliances include network terminal concentrators, network FAX servers, and network printers.
>
> A new type of network appliance is the NFS file server appliance. The requirements for a file system operating in an NFS appliance are different from those for a general purpose file system: NFS access patterns are different from local access patterns, and the special-purpose nature of an appliance also affects the design.

Hitz does not even mention the word "controller" in the cited text. Hitz simply does not teach a controller with snapshot logic and copy logic.

The examiner may have confused the terms "appliance" (which Hitz teaches) and "controller" (which the claim recites). To identify them is an error. Hitz states several times in the abstract and introduction that his "appliance" is a "file server." The specification and figures of the present application, however, show that a "file server" is distinct from a "controller," which means that an "appliance" is not a "controller." In figure 7, the file server 402 is shown controlling copy and snapshot on controllers 426, 432, and 436. The specification also explains the difference between a controller and a file server on page 13, lines 26-29.

There is a second reason why it is an error to identify "appliance" (which is a "file server") and "controller." Claim 23 itself distinguishes a "file server" from a "controller" by reciting both terms. If the applicant were using the word "controller" in a non-standard way to

mean "file server," he would have claimed a "controller ... operable to ... send ... commands ... to copy data from the source volume directly to the target volume without having [the controller] in the data path." He did not. Instead he introduced a new term, "a file server."

Therefore, Hitz does not disclose any kind of controller. In particular, Hitz does not disclose a controller with snapshot logic and copy logic, and Hitz does not teach that a controller's snapshot logic uses a snapshot map and a snapshot data to maintain coherency of copied data.

Meyer also does not disclose a controller with snapshot logic, and Meyer does not overcome the deficiency of Ohran and Hitz. The examiner acknowledges that neither Ohran nor Hitz "teaches a system wherein the data is directly transferred between the source and destination storage devices without traversing a file server," looking to Meyer for a controller with copy logic having the functionality recited in claim 23. However Meyer's controller does not meet the limitations of the recited copy logic.

Meyer teaches using DMA (direct memory access) to directly transfer data from one EIDE storage device to another. Meyer's controller can use DMA to transfer data directly from one hard drive to another, see column 6. The DMA command must be specified at a very low level, including the source and destination addresses and how many bytes to read or write, see column 2, lines 7-19.

Claim 23 recites a controller with snapshot logic. While Meyer discloses a controller, Meyer does not disclose that the controller includes snapshot logic. Claim 23 also recites that the controller's copy logic "us[es] the snapshot map and the snapshot data to maintain coherency of the copied data." The examiner asserts that Meyer teaches a "system wherein the data is directly transferred between the source and destination file storage devices without traversing a file server." This oversimplifies the applicant's claim and overstates what Meyer teaches. Meyer teaches a low-level DMA transfer, where the controller is simply told where to get each byte and where to put it. This DMA transfer does not "us[e] the snapshot map and the snapshot data to maintain coherency of the copied data."

Claim 23 is not obvious because none of Ohran, Hitz, and Meyer, taken together or separately, teach all of the elements of claim 23. The applicant submits that for at least the reasons presented above, claim 23, as well as claims 24-30, which depend from claim 23, are in condition for allowance.

Claim 31 recites receiving at a storage device controller a snapshot command specifying a range of data bytes. In response the storage device controller makes a snapshot map and snapshot data. It then receives a copy command. In response to the copy command, the storage device controller sends commands to one or more devices of the source and target volumes to copy data directly from the source volume to the target volume. In so doing, the storage device controller uses the snapshot map and snapshot data to maintain coherency of the copied data.

As previously stated, Ohran and Hitz fail to disclose a controller taking a snapshot. Meyer also fails to disclose this limitation.

As previously stated, Meyer fails to disclose copying directly "using the snapshot map and snapshot data to maintain coherency of the copied data." Ohran and Hitz also fail to disclose this limitation.

None of Ohran, Hitz, or Meyer, when taken alone or in combination, disclose these limitations. The applicant submits that for at least this reason claim 31, as well as claims 32-38 which depend from claim 31, are in condition for allowance.

Claim 39 recites using a remote application to manage a source storage device controller and a destination storage device controller. A snapshot version for each data block changed by write operations during the course of a copy operation is generated internally within the source storage device controller. Data blocks from the source device are copied to the destination device. If a snapshot version of a data block exists, the snapshot version is copied to the destination. Otherwise the regular version of the data block is copied to the destination. Data is directly transferred between the source and destination storage device controllers without traversing a server operable to process file system requests. Coherency of the data transferred

between the source and destination storage device controllers is maintained without requiring any file system to maintain a snapshot map.

As previously stated, Ohran and Hitz fail to disclose a "storage device controller generat[ing] a snapshot." Meyer also fails to disclose this limitation.

As previously stated, Meyer fails to disclose copying directly "using the snapshot map and snapshot data to maintain coherency of the copied data." Ohran and Hitz also fail to disclose this limitation.

None of Ohran, Hitz, or Meyer, when taken alone or in combination, disclose these limitations. The applicant submits that for at least this reason claim 39 is in condition for allowance.

Claim 40 recites a replication manager as well as a storage device controller. The controller receives a snapshot command and a copy command from the replication manager. In response to the snapshot command the controller makes a snapshot map and snapshot data. In response to the copy command the controller copies data from the source volume directly to the target volume without having a file server in the data path. The controller uses the snapshot map and the snapshot data to maintain coherency of the copied data.

As previously stated, Ohran and Hitz fail to disclose a "controller ... operable ... to take a snapshot." Meyer also fails to disclose this limitation.

As previously stated, Meyer fails to disclose copying directly "using the snapshot map and snapshot data to maintain coherency of the copied data." Ohran and Hitz also fail to disclose this limitation.

None of Ohran, Hitz, or Meyer, when taken alone or in combination, disclose these limitations. The applicant submits that for at least this reason claim 40, as well as claims 41-45, which depend from claim 40, are in condition for allowance.

Conclusion

For the foregoing reasons, the applicant submits that all the pending claims are in condition for allowance.

By responding in the foregoing remarks only to particular positions taken by the examiner, the applicant does not acquiesce with other positions that have not been explicitly addressed. In addition, the applicant's arguments for the patentability of a claim should not be understood as implying that no other reasons for the patentability of that claim exist.

Please apply the charge for a one-month extension of time and any other charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: 28 Mar 06

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